AMENDMENTS
In the Specification

[0011] More precisely the product of this aspect of the invention is specified in ~~claim 1~~ as a laminate comprising a monofilm-formed or multifilm-formed ply (A) and another monofilm-formed or multifilm-formed ply (B) both mainly consisting of orientable thermoplastic polymer material, in which A has a fluted configuration and B on a first side is adhesively bonded in bonding zones to the crests on a first side of A, characterized in that a) B also has a fluted configuration, the flute direction of B forming an angle from aenerally about 30° up to and including 90° to the flute direction of A and the said bonding zones being on the crests of the first side of B to produce spot bonding with the crests on the first side of A, b) the adhesive bonding is i) directly A to B and established through a lamination layer 'on A and/or B; ii) established through a separate thin bonding film; or iii) through a fibrous web adapted for bonding, and c) the wavelengths of the flutes in A and/or B are no longer than 5 mm, and the wavelengths of the flutes in both A and B are less than 10 mm. Preferably the wavelengths of the flutes in each of the plies are no more than 5 mm.

[0033] The method of making the present corrugated laminate of two monofilm-formed or multifilm-formed plies is defined in ~~claim 41~~ as a method of manufacturing a laminate of a first monofilm-formed or multifilm-formed ply with a second monofilm-formed or multifilm-formed ply both mainly consisting of orientable thermoplastic polymer material, in which the first ply has a waved flute configuration, and.the second ply on a first side is adhesively bonded in bonding zones to the crests on a first side of A, in which further the waved flute structure of the first ply is formed by the use of a grooved roller, and the said bonding with the second ply is carried out under heat and pressure and also under use of a grooved roller, characterized in that a) the second ply also is given a waved configuration, whereby under use of at least one grooved roller the flute direction of the second ply is made at an angle to the flute direction of the first ply and the said bonding zones are established on the crests of the first side of the second ply to introduce spot bonding with the crests on the first side of the first ply, b) the adhesive bonding i) is directly first to second ply and established through a lamination layer on at least one of these plies; ii) established through a separate thin bonding film; or iii) established through a fibrous web adapted to the bonding; and c) the wavelengths of the flutes in both plies are no longer than 10 mm, and the wavelengths of the flutes in at least one of the plies are no longer than 5 mm. Preferably the main direction in which the flutes of one of the plies extends is generally substantially perpendicular to the main direction in which the

flutes of the other ply extends. As it will appear from explanations below, the flutes are not always strictly rectilinear, and therefore the expression "main direction" is used. Preferably one of the flute directions essentially coincide with the machine direction of the lamination.

[0039] Suitable dimensions in the laminate and divisions on the laminating rollers are stated in the product ~~claims 3 to 6~~ as laminates: characterized in that the flute wavelength in each of the two plies is no more than 4 mm, preferably no more than 3 mm and still more preferably no more than 2 mm; characterized in that in each of the two plies the curved length of a flute is on average at least 5% and preferably at least 10% longer than the linear wavelength, the curved length being understood as the length of a curve·through the cross section of a full flute wave including the bonding zone which curve lies in the middle between the two surfaces of the ply; characterized in that in at least one of said plies the said average is at least 15%; characterized in that the width of each bonding zone in at least one·of the two plies is no less than 15%, preferably no less than 20%, and still more preferably no less than 30% of the flute wavelength and in method ~~claim 47~~ as a method characterized in that the' pitch of the grooved roller, which produces the lamination on the crests is at the highest 3.0 mm, preferably no more than 2.0 mm and still more preferably no more than 1.5 mm and in apparatus ~~claims 97 and 98~~ as apparatus in which the land on the crest of the or each grooved laminating roller is at least 15%, preferably at least 20%, more preferably at least 30% of the pitch of the grooved of that roller; comprises a grooved roller for fluting a first ply of thermoplastic polymer material, a grooved roller for fluting a second ply of thermoplastic polymer material, means for directing the first and second plies from their respective grooved rollers between a set of laminating devices with the plies arranged in face to face contact with one another and with the flutes of the first ply generally directed at an angle to the flutes of the second ply, the set of laminating devices, comprising, on the side facing the second ply, a heated porous bar and on the side facing the first ply, an opposite laminating device, wherein said porous bar is adapted to produce a film of hot air to press the plies towards the opposite laminating device and bond the plies together at the crests of the flutes of the second 10 ply to form a laminate, and the opposite laminating device is a roller or a porous bar, the grooved fluting rollers having groove pitches such that in the laminate the plies each have flutes of wavelength less than 10 mm and the flutes of at least one of the plies have a wavelength no longer than 5 mm. Cross-sectional dimensions are measured on micrographs.

[0040] With reference to FIGS. 2 and 3, the lengths, ~~mentioned in claim 4 as a laminate~~ characterized in that in each of the two plies the curved length of a flute is on average at least 5%

and preferably at least 10% longer than the linear wavelength, the curved length being understood as the length of a curve through the cross section of a full flute wave including the bonding zone which curve lies in the middle between the two surfaces of the ply, are distances from X to Z one following the curved route through the middle of A, the other the direct, linear route.

[0047] For most applications it is highly preferable that either the thickness of each of the said plies is generally the same in bonded and unbonded zones, or at least one ply exhibits solid-state attenuated zones, in the following referred to as the "first" such zones, formed by a so-called "segmental stretching", and extending parallel to the flute direction, each bonding zone mainly being located within such a first attenuated zone. Herein each first attenuated zone is understood as delimited by the positions where the thickness is an average between the minimum thickness of this ply within the first attenuated zone and the ply's maximum thickness within the adjacent non-bonded zone. The method of making the fluted laminate with such first solid-state attenuated zones located as mentioned requires a strict coordination between stretching rollers and lamination rollers, and is specified: ~~in claims 44~~ as a method characterized in that prior to the said bonding process at least one of said plies is solid-state stretched in narrow zones to form first attenuated zones which are parallel to the selected direction of fluting in the ply, said stretching being generally perpendicular to the said direction and carried out between a set of grooved rollers both different from the grooved roller for lamination, and that the grooved roller for lamination is coordinated with the said set of grooved rollers for stretching in such a way that each zone of bonding mainly becomes located within a first attenuated zone; ~~and 50~~ as a method characterized in that a suitably distinct stripe formation of the first attenuated zone is established at least in part by giving the crests on the grooved stretching roller intended to produce the stripes a temperature which is higher than the temperature on the crests on the other grooved stretching roller and/or by giving the crests on the grooved stretching roller intended to produce the stripes a radius of curvature which is smaller than the radius of curvature of the crests on the matching grooved stretching roller;~~, 75~~ as an apparatus comprising a first set of grooved stretching rollers upstream from the laminating station for at least one of the plies, which stretches the material of the respective ply in a solid state and in a direction generally perpendicular to the flutes to form first attenuated zones, wherein the grooved stretching rollers, grooved fluting rollers and grooved laminating rollers are coordinated so that the first attenuated zones become the crests of the flutes and the bonding zones are mainly located within first attenuated zones;~~, 81~~ as an apparatus in which the last of the grooved stretching rollers is in close proximity to the grooved

laminating roller and the grooves of each are of the same pitch at the operating temperature of the apparatus and being aligned; and ~~82~~ as an apparatus which comprises one or a series of heated grooved transfer rollers located between the last of the grooved stretching rollers and the grooved laminating roller, adjacent rollers being close together, the grooves of the stretching, transfer and laminating rollers having the same pitch at the operating temperature of the apparatus and being aligned with one another.

[0049] The first attenuated zones are shown as (6) in FIGS. 2 and 3. They are here shown as almost exactly coinciding with the zones of bonding in the sections shown, which are sections drawn through the bonded spots. However, they need not be coincident like this, since the requirement only is that each bonding zone mainly is located within a first solid-state attenuated zone. Thus, the bonding zones can to some degree extend beyond the first attenuated zones, or the latter can extend beyond the former. Preferable choices of relative zone widths for the last case are specified ~~in claim 22~~ as a laminate in which first attenuated zones are present in at least one of the plies and in which the bonding zones are generally coincident with the first attenuated zones.

[0052] A suitable method of achieving almost precise correspondence of the first attenuated zones with the bonding zones, at least in one ply, is to adjust the roller temperatures to the thickness of the attenuated zones, at least in on ply, is to adjust the roller temperatures to the thickness of the attenuated zones and to the velocity of the plies, in such a way that these zones reach a temperature which makes them laminate adequately to the other ply, while the film material outside the zones due to its thickness does not reach a sufficient temperature. A condition is that the flat crests on the grooved lamination roller are wider than and extend beyond each of the "first attenuated zones". This is defined: ~~in claims 22~~ as a laminate in which first attenuated zones are present in at least one of the plies and in which the bonding zones are generally coincident with the first attenuated zones;~~, 46~~ a method in which the lamination layer is heated to the lamination temperature by heating from the opposite side of the ply, and in which the temperature of the laminating roller and the thickness of the film in the first attenuated zones is such as to allow the laminating layer to reach said lamination temperature whilst the thickness of the ply outside the attenuated zone which is in contact with the crests of the grooved lamination roller is such that the lamination layer outside the attenuated zone does not reach said lamination temperature, where the first attenuated zones and the bonding zones become generally coincident; and ~~77~~ as an apparatus in which the crests of the grooves of the laminating roller are wider than the first attenuated zone and in which the side of the ply opposite

to the face in contact with the other ply is heated in the lamination station, preferably by supplying heat to the interior of the grooved laminating roller.

[0055] In addition to first attenuated zones in at least one of the two plies, such ply can be supplied with a further set of solid-state attenuated zones, hereafter referred to as the second such zones. They are located between each pair of adjacent first attenuated zones are narrower than said first attenuated zones and are placed on the non-bonded crests of the respectively ply. This is illustrated in FIG. 3. The method of manufacturing these second attenuated zones is specified ~~in claim 45~~ as a method characterized in that prior to or after the formation of the first attenuated zones, another set of grooved rollers produces second attenuated zones which are another series of solid state oriented narrow zones in the same ply, parallel with the first attenuated zones and narrower than the latter, while the grooved rollers which produce 20 said second attenuated zone are coordinated with the grooved rollers which produce the first attenuated zones so that each second attenuated zone becomes located generally in the middle between two neighboring first attenuated zones and as apparatus ~~is defined in claim 76~~ comprising, between the said grooved stretching rollers and the laminating station, a second set of grooved stretching rollers, which stretches the material of the said respectively in a solid state and in a direction generally perpendicular to the flutes to form second attenuated zones extending parallel to and between said first attenuated zones which are narrower than said first attenuated zones, whereby the second attenuated zones become the troughs of the flutes.

[0061] Preferable ways of coordinating and carrying out the different grooved roller operations are further specified: ~~in claims 53 to 57~~ as methods characterized in that this ply is passed from its exit from the last of the grooved and fluting rollers to the grooved lamination roller over one or a series of heated, grooved transfer rollers, the grooved rollers in the row starting with the grooved stretching rollers and ending with the grooved lamination roller each being in close proximity to its neighbor or neighbors, whereby each of the grooved rollers in the row has the same pitch when measured at their respective operational temperature, and being mutually adjusted in the axial direction for alignment of the grooves; characterized in that each grooved roller used to form the flutes in one of the plies and each grooved roller used to form the first attenuated zones in this ply if such zones are produced, and each grooved roller used to form the second attenuated zones if such zones are formed in this ply and a grooved roller which the ply follows before and during the lamination if such roller is used, are rollers in which the grooves are essentially parallel with the roller axis, and means are

provided to hold the flutes of the said ply in the respective grooves during the passage from the position where the flutes are formed to the position where lamination takes place, said holding means adapted to avoid a frictional rubbing on the ply during said passage; characterized in that the flutes in this ply are formed by use of an air jet or a transverse row of air jets which directs A into the 'grooves on the forming roller; characterized in that first attenuated zones are formed by grooved rollers acting in coordination with the grooved roller used for lamination, and said coordination consists in an automatic fine regulation of the relative velocities between the rollers; and characterized in that said second attenuated zones are formed by grooved rollers acting in coordination with the grooved rollers used to produce the first attenuated zones, and said coordination consists in an automatic fine regulation, of the relative velocities between the rollers and ~~in~~ as apparatuses: ~~claims 81 to 84~~ in which the last of the grooved stretching rollers is in close proximity to the grooved laminating roller and the grooves of each are of the same pitch at the operating temperature of the apparatus and being aligned; comprising one or a series of heated grooved transfer rollers located between the last of the grooved stretching rollers and the grooved laminating roller, adjacent rollers being close together, the grooves of the stretching, transfer and laminating rollers having the same pitch at the operating temperature of the apparatus and being aligned with one another; in which the grooved fluting roller for one of the plies has the grooves arranged substantially parallel with the roller axis and in which substantially frictionless holding means are provided for holding the flutes of the respective ply in the grooves; and in which the frictionless holding means comprises air pressure difference between opposite sides of the ply at the groove.

[0077] As it appears especially from the introduction, the present invention is expected to be applicable in several very different fields of uses, also uses where stiffness is the most important requirement, for example the use for stand-up pouches. ~~Claim 30~~ A laminate characterized in that by the choice of polymer material or by an incorporated filler or by orientation, the coefficient of elasticity E in at least one of the plies, measured in the unbonded zone of the ply in the direction parallel to the flute, as an average over the unbonded zone is no less than 700 MPa, and preferably no less than 1000 MPa specifies the stiffness selected for such applications.

[0079] The encapsulation/canalization aspect comprises a number of embodiments which for different practical purposes utilize the interior cavities in the laminate, optionally in combination with suitable perforations, either to canalize a flow of liquid or air, or to encapsulate filling material

in particular, fibrous, filament or liquid form. The latter may e.g. be a preservative for goods packed in the flexible laminate. These different embodiments and some of their applications appear from products: ~~claims 31 to 39~~ characterized in that at least some of the channels formed by the flutes in A and B, which channels may be closed to pockets, contain a filling material in particulate, fibrous, filament or liquid form; characterized in that said material is a preservative for goods intended to become packed in or protected by the laminate, preferably an oxygen scavenger or ethylene scavenger, a biocide, such as a fungicide or bactericide, a corrosion inhibitor or a fire extinguishing agent, optionally with micro-perforations established in the flutes to enhance the effect of said preservative; characterized in that both A and B are supplied with a multitude of perforations, whereby the perforations do not reach into the bonded spots, and the perforations in A are displaced from the perforations in B so as to cause gas or liquid when passing through the laminate, to run a distance through the flutes generally parallel to the main surfaces of the laminate; the channels formed by the flutes may be closed to form pockets; characterized in that the channels or pockets contain filling material adapted to act as a filter material by holding back suspended particles from a fluid passing through the channels or pockets or is an absorbent or ion-exchanger capable of absorbing or ion-exchanging matter dissolved in such fluid, said filler optionally being fibre-formed or yarn-formed; in which by choice of hydrophobic properties of at least the inner surfaces of the channels or pockets formed by the flutes and by selected small spacing of said channels or pockets, and choice of the distances between the mutually displaced perforations in A and B, there is achieved a desirable balance between the pressure needed to allow water through the laminate and the laminate's capability to allow air and vapour to pass there through; characterized by a nap of fibre-like film portions protruding from the borders of the perforations of at least on one surface of the laminate; used as a sanitary backsheet, preferably on a diaper or as a sheet for covering a patient during surgery; used for insulation of buildings; and used as a geotextile which allows water to pass but holds fine particles back, methods of making these products: ~~will appear from claims 60 to 66~~ characterized in that particulate, liquid or fibre-or yarn-formed material is filled into some at least of the channels formed by the two arrays of flutes, this filling taking place prior to or during the lamination; characterized in that after filling the filled channels are closed at intervals by pressure and heat to form filled pockets; characterized in that prior to, simultaneously with or following the filling step perforations are made in the laminate at least on one side to help the filling material or part thereof dissipate into the surroundings or to allow air or liquid to pass through the filling

material; characterized in that there is made a multitude of perforations in the first and in the second ply, but limited to areas, where the two plies are not bonded together, and the perforations in the first ply being displaced from the perforations in the second ply to force air or liquid which passes through the laminate to run a distance along one or more channels; characterized in that in one process step there is melted a multitude of holes in the first but not in the second ply or in the second but not in the first ply, these holes being formed by contacting flutes of the first ply with protruding surface parts of a hot roller, which are moved at essentially the same velocity as the laminate; characterized in that the holes are formed by contacting flutes of the second ply with protruding preferably sharp, surface parts of a hot roller, which are moved at essentially the same velocity as the laminate, while heat insulating material prevents the flutes from contacting the hot surfaces of the roller, and preferably the laminate is pressed towards the protruding parts by means of air jets; characterized in that there is drawn a protruding nap of fibre-like film portions out from the molten surroundings of the holes by blowing air in between the laminate and the hot roller, where the laminate leaves the roller and apparatuses: ~~is defined in claims 85 to 87~~ in which downstream of the grooved laminating roller in the lamination station there is a flute flattening station in which at least some of the flutes in each ply are flattened and the plies bonded to one another under heat and pressure to form closed pockets; in which the flute flattening station comprises bars and/or cogs extending generally in the machine direction or the cross-direction and counter rollers, bars or cogs against which to bear; comprising flute filling means for filling the flutes of one or both plies before or during the lamination station with particulate, fibre or liquid material. The embodiment of the present invention in which the fine canals or pockets are used to entrap preservatives, have obvious advantages over the usual method of blending such agents with the polymers to be extruded into film form. One advantage is that the concentration of the preservative can be much higher, another that the preservative needs not be able to withstand the temperature of extrusion. The preservative may reach the object to be preserved by migration alone, or if the agent is solid it may gradually evaporate and diffuse through sufficiently fine perforations or pores.

[0081] The filter material stated in ~~claim 34 34.~~ a laminate characterized in that the channels or pockets contain filling material adapted to act as a filter material by holding back suspended particles from a fluid passing through the channels or pockets or is an absorbent or ion-exchanger capable of absorbing or ion-exchanging matter dissolved in such fluid, said filler optionally being fibre-formed or yarn-formed has many potential uses, e.g. as a geotextile (~~claim 39~~ A laminate used as a geotextile

which allows water to pass but holds fine particles back) but also for instance for water treatment in the chemical industry and in gas face masks.

[0082] The laminate ~~of claim 35~~ in which by choice of hydrophobic properties of at least the inner surfaces of the channels or pockets formed by the flutes and by selected small spacing of said channels or pockets, and choice of the distances between the mutually displaced perforations in A and B, there is achieved a desirable balance between the pressure needed to allow water through the laminate and the laminate's capability to allow air and vapor to pass therethrough, which makes use of the capillary effects within the channels formed by the flutes, is an improvement over micro porous film for similar purposes, since the balance between the water stopping and air allowing effects can be optimized. The uses are especially as backsheet e.g. on diapers, for moisture protection in building constructions, and for "breathable" bags. However, for other purposes such as e.g. manufacture of a filter material for waterbased suspensions, there may contrarily be given hydrophilic properties to at least the inner surfaces of the channels or pockets formed by the flutes. This can be achieved by the choice of the polymer material which forms these surfaces, or by a surface treatment, e.g. by pressing or sucking corona-treated air from one surface to the other through the described system of perforations and channels.

[0085] The special way of making the perforations by melting, as ~~claimed in claim 64~~ described in a method characterized in that in one process step there is melted a multitude of holes in the first but not in the second ply or in the second but not in the first ply, these holes being formed by contacting flutes of the first ply with protruding surface parts of a hot roller, which are moved at essentially the same velocity as the laminate and ~~claim 65~~ a method characterized in that the holes are formed by contacting flutes of the second ply with protruding preferably sharp, surface parts of a hot roller, which are moved at essentially the same velocity as the laminate, while heat insulating material prevents the flutes from contacting the hot surfaces of the roller, and preferably the laminate is pressed towards the protruding parts by means of air jets, is simple and reliable to practise since the crests on the two surfaces of the laminate are protruding so that the hot roller parts safely can form holes in one ply without harming the other ply. It is also a fast method. Further details appear from example 4.

[0086] As specified in ~~claim 66~~ a method characterized in that there is drawn a protruding nap of fibre-like film portions out from the molten surroundings of the holes by blowing air in between the laminate and the hot roller, where the laminate leaves the roller, the material which is melted in the

process of melt perforating can be dragged to form the nap claimed in claim 36 as a laminate characterized by a nap of fibre-like film portions protruding from the borders of the perforations of at least on one surface of the laminate. In this case the surface contacting the nap-dragging hot roller must consist of a polymer material which sticks sufficiently to the roller, e.g. it may consist of an ionomer/ethylene copolymer. This can e.g. give a napkin or a sheet for covering a patient during surgery a textile-like feel. Apparatus is defined in claims 88 to 91 as comprising perforating means for cutting or melting holes into the flutes of one or both plies in non-bonded zones; Apparatus defined in which the perforating means comprise a driven perforating roller having an arrangement of heated protrusions which contact and melt the material in the flutes of the respective ply. Apparatus defined as further comprising pressurized air outlets for directing air at the ply while the material surrounding the perforations is molten. Apparatus defined in which the flutes of the ply are directed into contact with said protrusions by air jets directed at the surface of the ply opposite to the perforating roller.

[0089] A further aspect of the invention, in which one or both of the plies is or are flat when fed to the laminating rollers is provided in claim 67 to 73 as a method of manufacturing a laminate of a first ply with a second ply both mainly consisting of orientable thermoplastic polymer material and each having one face comprising a lamination layer in which the first and second plies are continuously fed in face to face relationship with the lamination layers in direct contact with one another between a pair of laminating rollers between which heat and pressure is applied, whereby the lamination layers become adhered to one another, in which the second ply is oriented mainly transversely of the machine direction, and is generally not shrinkable in solid state in the direction transverse to its orientation, and the first ply as it is fed to the lamination rollers is heat-shrinkable mainly in a shrink direction which is generally parallel with the machine direction, the lamination rollers apply heat and pressure in bonding zones arranged in continuous or discontinuous rectilinear lines extending in a direction which is generally perpendicular to said shrink direction, and after lamination the first ply is caused to shrink in solid or semisolid state in the said shrink direction, whereby the second ply becomes fluted with flutes extending perpendicular to said shrink direction and having a wavelength at the highest about 5 mm; as a method of manufacturing a laminate of a first ply with a second ply both mainly consisting of orientable thermoplastic polymer material and each having one face comprising a lamination layer in which the first and second plies are continuously fed in face to face relationship with the lamination layers in direct contact with one another between a set of laminating

devices between which heat and pressure is applied, whereby the lamination layers become adhered to one another, in which the second ply is oriented mainly transversely of the machine direction, and is generally not shrinkable in solid state in the direction transverse to its orientation, and is prior to the lamination rollers, segmentally stretched in its machine direction to introduce first attenuated zones perpendicular to the machine direction, the first ply as it is fed to the lamination rollers is heat-shrinkable mainly in a shrink direction which is generally parallel with the machine direction, the laminating devices comprise on the side facing the second ply a heated flat roller or a heated porous bar adapted to produce a film of hot air to press the plies towards the opposite laminating device, which may be either a roller or a similar bar, the speed of the machine and the temperatures of the rollers being adapted to heat the lamination layer in said first attenuated zones to the lamination temperature, but not to heat the lamination layer in the adjacent non-attenuated zones to the lamination temperature, whereby bonding takes place only in the attenuated zones, and after lamination the first ply is caused to shrink in solid or semisolid state in the said shrink direction, whereby the second ply becomes fluted with flutes extending perpendicular to said shrink direction and having a wavelength- at the highest about 5 mm; as a method in which said wavelength is at the highest about 3 mm; as a method in which the first ply is kept substantially flat throughout the manufacturing process; as a method in which the first ply is supplied with waves prior to the lamination, the wavelength being at the highest about 5 mm, preferably at the highest about 3 mm, and the lamination zones are on the crests on one side of the waved first ply; as a method characterized in that, by use of a take-off roller (13) of slightly waved surface, the laminate on its whole is supplied with a longitudinal waving to eliminate a tendency to curling around its transverse direction; as a method in which said rectilinear lines are discontinuous and in which the discontinuities in adjacent lines are aligned in the shrink direction. An example of this method is described below in Example 5.

[0090] Apparatus suitable for carrying out this method is ~~claimed in claims 92 to 96~~ a laminating apparatus comprising a grooved roller for fluting a first ply of heat-shrinkable thermoplastic polymer material having a main shrink direction parallel to the flute direction, means for continuously directing the fluted first ply and a second ply of thermoplastic material in face-to-face relationship to a laminating station, the laminating station comprising laminating rollers between which heat and pressure is applied in laminating zones between the crests of the flutes of the fluted first ply and the second ply whereby bonding zones are formed extending in continuous or discontinuous rectilinear

lines along the crests of the flutes at which the plies are bonded to one another, the apparatus further comprising a heat shrink station in which the first ply in the bonded product is heated to its heat shrink temperature and allowed to shrink, the bonding zones being adapted to allow the second ply to become fluted upon shrinkage of the first ply, the wavelength of the fluting being less than 5 mm; an apparatus in which the second ply is fed to the laminating station as a substantially planar web; an apparatus in which the laminating station comprises a pair of grooved rollers, between which the heat and pressure is applied for lamination, the grooves of the laminating roller in contact with the first ply being parallel to and under operating conditions, having the same pitch as the grooves of the fluting roller for the first ply, and the grooves of the laminating roller in contact with the second ply being arranged at an angle, preferably substantially perpendicular to these grooves; an apparatus in which the laminating station comprises a grooved laminating roller and a substantially smooth counter roller between which the heat and pressure is applied for lamination with the grooved laminating roller in contact with the first ply; the grooves of the grooved laminating roller being parallel to and, under operating conditions, having the same pitch as the grooves of the fluting roller for the first ply; an apparatus which comprises a stretching station for the second ply at which the second ply is segmentally stretched in solid state to produce first attenuated zones extending in a direction at an angle to the direction of the flutes of the first ply, preferably perpendicularly thereto, wherein the substantially smooth laminating roller is heated to a temperature which heats the opposite surface of the second ply in the first attenuated zones to the laminating temperature while the adjacent areas do not reach that temperature.